INSTRUCTION MANUAL

REGULATED POWER SUPPLIES

MODELS

LND-X-152
LND-X-MPU

MP MASTER
MA28811

LAMBDA

LAMBDA ELECTRONICS MELVILLE, L. I., N. Y.

INSTRUCTION MANUAL

FOR

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LND-X-MPU

This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics. All information contained herein applies to all LND-X models unless otherwise specified.

LAMBDA ELECTRONICS MELVILLE, L.I., N.Y.
MAIN PLANT TELEPHONE: 516-694-4200

IM-LND-X

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SPECIFICATIONS AND FEATURES

D. C. OUTPUT — Voltage regulated for line and load. See table I for voltage and current ratings.

TABLE I

MODELS	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS) AT AMBIENT TEMPERATURE*				INPUT POWER (WATTS)**
		40°C	50°C	60°C	71°C	
LND-X-152	±12	2.3	1.9	1.4	0.9	160
	±15	2.5	2.1	1.6	1.1	
LND-X-MPU	5 ±5%	7.0	6.0	4.7	3.2	145
	9 to 12	1.2	1.1	1.0	0.8	

Current range must be chosen to suit the appropriate maximum ambient temperature.
See below for LND-X-152 current ratings at different output voltages.

*Ratings apply for use with cover removed. Derate current 15% for each ambient temperature if cover is used. Refer to figure 13 for cover removal.

**With output loaded to full current rating and input voltage 127 volts AC, 60 Hz.

DETERMINATION OF CURRENT RATINGS FOR MODEL LND-X-152 AT OUTPUT VOLTAGES BETWEEN ±12 AND ±15 VOLTS — Current ratings vary linearily with output voltages. To determine current for any given output voltage (between rated limits) proceed as follows:

1. Determine operating ambient temperature.
2. Find constant (see formula) c in table II below.
3. Apply current formula:

$$Io = (0.067)\ Vo + c$$

where Io = output current, c = constant (see table II), and Vo = desired output voltage; determine output current.

TABLE II

40°C	50°C	60°C	71°C
c = 1.5	c = 1.1	c = 0.6	c = 0.1

REGULATED VOLTAGE OUTPUT (each side)

Regulation (line) ..... 0.1% for input variations from 105-127, 127-105, 210-254, or 254-210 volts AC.

Regulation (load) ..... 0.1% for load variations from no load to full load or full load to no load.

Ripple and Noise ..... 1.5 millivolts rms; 5 millivolts peak to peak.

Temperature Coefficient ..... Output change in voltage 0.3%/°C.

Remote Programming (LND-X-MPU only)
External Resistor ..... Nominal 200 ohms/volt output.
Programming Voltage ..... One-to-one voltage change.

Remote Sensing ..... Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

OVERSHOOT — No overshoot under conditions of power turn-on, turn-off, or power failure.

AC INPUT — 105-127 or 210-254* volts AC at 47-440 Hz. Standard LND-X power supplies are factory wired for 105-127 volt input, but can be rewired for 210-254 volt input. See figure 9 and schematic diagram for rewiring of AC input. For input power see table I. Ratings apply for 57-63 Hz input. For 47-53 Hz or 63-440 Hz input consult factory. Where applicable, regulatory agency approval applies only for input voltages up to 250VAC.
*Certified by Canadian Standards Association for 210-250 volt input.

TRACKING (LND-X-152 only) — Absolute voltage difference of either negative or positive output from nominal within 3%; 0.2% change for all conditions of line, load, and temperature.

OVERLOAD PROTECTION
Thermal ..... Thermostat, resets automatically when over temperature condition is eliminated.
Electrical ..... Automatic electronic current limiting circuit, limits output current to a safe value. Automatic current limiting protects the load and power supply when external overloads and direct shorts occur.

OVERVOLTAGE PROTECTION — Model LND-X-MPU includes fixed built in overvoltage protection circuits which prevent damage to the load caused by excessive power supply output voltage. See table III for overvoltage protection firing range.

TABLE III

OUTPUT	OVERVOLTAGE PROTECTION TRIP-POINT (VOLTS)
5V ±5%	6.4 to 6.8
9 to 12V	13.3 to 14.1

INPUT AND OUTPUT CONNECTIONS — Refer to figure 13 for location.
AC input ..... Screw terminals on printed circuit board.
Ground ..... Terminal on transformer.
DC output ..... Screw terminals on printed circuit board.
Sensing ..... Turret terminals on printed circuit board.
Overvoltage Protector (LND-X-152 only). . Quick disconnect terminal on printed circuit board with mating connector attached.

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE — Continuous duty from 0°C to 71°C ambient with corresponding load current ratings for all modes of operation.

STORAGE TEMPERATURE — -55°C to +85°C.

FUNGUS — LND-X power supplies are fungus inert.

DC OUTPUT CONTROL — Screwdriver voltage adjust control(s) permits adjustment of DC output voltage. Refer to figure 13 for location of control(s). One control for dual output of LND-X-152.

PHYSICAL DATA

Size	7" x 4-7/8" x 2-7/8" with cover in place 7" x 4-7/8" x 2-3/4" with cover removed
Weight	7-3/4 lbs. net; 8-1/4 lbs. shipping
Finish	Gray, FED. STD. 595 No. 26081.

MOUNTING — Three surfaces, two with tapped mounting holes and one with clearance mounting holes, can be utilized for mounting this unit. Refer to figure 13 for mounting details.

"J" OPTION — LND-X power supplies can be obtained for 90-110 VAC, 47-440 Hz input. Ratings apply for 57-63 Hz input. For 47-53 Hz or 63-440 Hz input consult factory.

ACCESSORIES

Overvoltage Protector	L-12-OV Series Overvoltage Protectors are available.

THEORY OF OPERATION

GENERAL

The text in this section refers to components associated with the plus (+) side of the LND-X-152 power supply and the 5 volt output of the LND-X-MPU power supply, however, the discussion is equally applicable to the LND-X-152 minus (-) side and LND-X-MPU 9 to 12 volt output which have similar components, except for potentiometer R10 which is not used on the (-) side of LND-X-152.

The Lambda power supply consists of an AC input circuit and transformer; a bias supply consisting of an auxiliary rectifier and filter, and pre-regulator; a main regulator circuit consisting of the main rectifier and filter, a series regulator, voltage sensing network, current sensing resistor, voltage reference*, voltage and current comparators*, and amplifier*.

*This circuit element is part of integrated circuit (IC1) in the supply.

The circuit arrangement is shown in block diagram form, figure 10. The circuitry is discussed with reference to the block diagram and the schematic diagram.

FUNCTIONAL DESCRIPTION

Single phase input power is applied to transformer T1 through the input circuit which contains a thermostat to protect the supply against overheating.

The main rectifier, a full wave rectifier, provides the power which is filtered by capacitor C1, and then regulated via a series regulator and delivered to the output. Half-wave auxiliary rectifier CR3 provides voltage filtered by capacitor C2 for preregulator CR4. The reference element, powered by the preregulator, provides a reference voltage for the voltage comparator.

Constant voltage circuit operation is determined by changes in line or load which cause a change in one input to the voltage comparator through voltage dividers R9, R10, and R6. A second input to the comparator is a reference voltage developed in IC1. The comparator compares the output voltage change with the reference voltage resulting in an error signal at the output of the comparator.

The error signal from the comparator controls the voltage across series regulator Q1, which functions as the active regulating elements in the supply.

Current limit circuit operation is determined by changes in the load. The current comparator samples load current through current sensing resistor R7 and, as applicable, R8. When the voltage drop across R7 (R8) increases to a preset voltage reference determined by R4 and R5, the current comparator conducts. Thus, when the output current rating of the unit is exceeded, the current comparator conducts, decreasing the drive to Q1, resulting in an increase of voltage across the series regulator and a decrease of the output voltage, effectively limiting the output current to a safe value. The current limit value is determined by resistors R4 and R5.

When operating conditions approach short circuit, the output voltage decreases. Since the voltage deter mined by R4 and R5 is proportional to the output voltage, when the output voltage decreases, the amplifier is biased into turn on at lower and lower load currents until output voltage decreases to zero and current decreases to a predetermined low value.

Voltage tracking of model LND-X-152 slave section to the master section is accomplished as follows:

When the output voltage increases, voltage across R23 and R28 also increases, causing an increase in one input to comparator located in IC21. The comparator compares this change with the output voltage reference of the slave unit resulting in an error signal at the output of the comparator. The error signal from the comparator controls the voltage across series regulator Q21, which functions as the active regulating element in the slave section.

OV CIRCUIT, FUNCTIONAL DESCRIPTION (LND-X-MPU only)

When the power supply output voltage increases above the overvoltage limit, HC1 or, as applicable, IC22 fires causing the power supply output voltage to drop.

OPERATING INSTRUCTIONS

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40°C. For continuous operation, load current must not exceed the rating for each ambient temperature. When rated load current is exceeded, both voltage and current decrease until voltage reaches zero and the current at short circuit equals approximately 40 percent or less of the rated current.

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying AC input power.

Ground Connections. The Lambda power supply can be operated either with negative, positive, or common terminal grounded. Positive, negative, and common ground connections are shown for all suggested output connections illustrated in this manual.

Connection Terminals. Make all connections to the supply at the terminals provided. Apply input power to AC terminals; always connect the ungrounded (hot) lead to terminal indicated in figures 3 through 8. The supply positive terminal is brought out to terminal +V. The supply common terminal is brought out to terminal COM. The supply negative terminal is brought out to terminal -V. Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 8. Selection of proper wiring is made on the basis of load requirements. Make all performance checks and measurements of current or voltage at the rear output terminals. Connect measuring devices directly to terminals or use the shortest leads possible.

SUPPLY LOAD CONNECTIONS

Connections For Operation as a Constant Voltage Source. The output impedance and regulation of the power supply at the load may change when using the supply as a constant voltage source and connecting leads of practical length are used. To minimize the effect of the output leads on these characteristics, remote sensing is used. Recommended types of supply-load connections with local or remote sensing are described in the following paragraphs.

Refer to figure 1 to determine voltage drop for particular cable length, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Local Sensing Connection, Figure 3 (LND-X-152) or Figure 5 (LND-X-MPU). Local sensing is the connection suitable for applications with relatively constant load or for applications with short power output leads. Any load connection combination as shown in the figure can be used.

Remote Sensing Connection, Figure 4 (LND-X-152) or Figure 6 (LND-X-MPU). Remote sensing provides complete compensation for the DC voltage drops in the connecting cables. Sensing leads should be a twisted pair to minimize AC pick-up. A 2.5mf elect., capacitor may be required between output terminals and sense terminals to reduce noise pick-up.

Programmed Voltage Connections, Using External Resistor, Figure 7 (LND-X-MPU Only). Discrete voltage steps can be programmed with a resistance voltage divider valued at 200 ohms/volt change and a shorting-type switch as shown in figure 7. When continuous voltage variations are required, use a variable resistor with the same 200 ohms/volt ratio in place of the resistive voltage divider and shorting-type switch. Use a low temperature coefficient resistor to assure most stable operation.

Before programming, adjust programming resistor for zero resistance and set voltage adjust control to the minimum rated output voltage. Output voltage of programmed supply will be minimum output voltage plus 1 volt per 200 ohms.

As shown in figure 7, voltages can be programmed utilizing either local or remote sensing connections, as desired.

Programmed Voltage Connections Using Programming Voltage, Figure 8 (LND-X-MPU Only). The power supply voltage output can be programmed with an externally connected programming power supply. The output voltage change of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply. If the output voltage control of the programmed supply is set to minimum output voltage, output voltage of the programmed supply will be minimum output voltage plus voltage of programming supply.

The programming supply must have a reverse current capability of 6 ma. minimum.

Alternatively when supplies with less than 6 ma. reverse current capability are used, a resistor capable of drawing 6 ma. at the minimum programming voltage must be connected across the output terminals of the supply. The programming supply must be rated to handle all excess resistor current at the maximum programming voltage.

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermostat Shutdown

The thermostat opens the input circuit only when the temperature of the heat sink exceeds a maximum safe value. The thermostat will automatically reset when the temperature of the heat sink decreases to a safe operating value. After eliminating the cause(s) for overheating and allowing time for the power supply to cool to a proper temperature, resume operation of the supply.

Overvoltage Shutdown (LND-X-MPU Only).

When the power supply output voltage increases above the overvoltage limit; HC1 or, as applicable, IC22 will short circuit output of the supply. After eliminating the cause(s) for overvoltage, resume operation of the supply by momentarily interrupting the AC input circuit, (refer to Trouble Shooting Chart).

MAINTENANCE

GENERAL

This section describes trouble analysis routine, replacement procedures, calibration and test procedures that are useful for servicing the Lambda power supply. A trouble chart is provided as an aid for the troubleshooter. Refer to the section on specifications and features for the minimum performance standards.

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check fuse, primary power lines, external circuit elements, and external wiring for malfunction before trouble shooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumper and supply-load connections or fuse failure due to metal fatigue.

Use the electrical schematic diagram and block diagram, figure 10, as an aid to locating trouble causes. The schematic diagram contains various circuit voltages that are averages for normal operation. Measure these voltages using the conditions for measurement specified on the schematic diagram. Use measuring probes carefully to avoid causing short circuits and damaging circuit components.

CHECKING TRANSISTORS AND CAPACITORS

Check transistors with an instrument that has a highly limited current capability. Observe proper polarity to avoid error in measurement. The forward transistor resistance is low but never zero; backward resistance is always higher than the forward resistance.

For good transistors, the forward resistance for any junction is <u>always</u> greater than zero.

Do not assume trouble is eliminated when only one part is replaced. This is especially true when one transistor fails, causing other transistors to fail. Replacing only one transistor and turning pow(on, before checking for additional defective components could damage the replaced component.

When soldering semi-conductor devices, wherever possible, hold the lead being soldered with a pair of pliers placed between the component and the solder joint to provide an effective heat sink.

> <u>NOTE</u>: The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor. In all cases the capacitors are shunted with resistances. some of which have low values. Only a dead short is a true indication of a shorted capacitor.

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1. If foil is intact but not covered with solder it is a good contact. Do not attempt to cover with solder.

2. Voltage measurements can be made from either side of the board. Use a needlepoint probe to penetrate to the wiring whenever a protective coating is used on the wiring. A brass probe can be soldered to an alligator clip adapted to the measuring instrument.

3. Wherever possible use a heat sink when soldering transistors.

4. Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering. To repair small breaks, tin a short piece of hook-up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry.

5. When unsoldering components from the board never pry or force loose the part; unsolder the component by using the wicking process described below:

a) Select a 3/16 inch tinned copper braid for use as a wick; if braid is not available, select AWG No. 14 or No. 16 stranded wire with 1/2 inch insulation removed.

b) Dip the wick in liquid rosin flux.

c) Place the wick onto the soldered connection and apply soldering iron onto the wick.

d) When sufficient amount of solder flows onto the wick, freeing the component simultaneously remove iron and wick.

TROUBLE CHART

The trouble chart is intended as a guide for locating trouble causes, and is used along with the schematic diagram.

The operating conditions assumed for the trouble chart are as follows:

a) AC power of proper voltage and frequency is present at input terminals.

b) Either positive, negative, or common terminal is connected to chassis ground.

c) The power supply is connected for constant voltage with local sensing. See schematic; dotted lines indicate jumpers connected for local sensing operation.

TROUBLE SHOOTING CHART

Symptom	Possible Cause	Remedy
1. Zero volts DC output, both sides of LND-X-152 or 5V output of LND-X-MPU.	Short circuit across output of supply.	Check load and load connections, correct as necessary.
	Q1, R7, R8 open.	Check Q1, R7, R8 for open, replace as necessary.
	Shorted CR6 or C4.	Check CR6 and C4 for short, replace as necessary.
	IC1 defective.	Voltage at pin 6 must measure above rated output voltage. If reading exceeds nominal voltage rating by 3 volts or if less than output voltage rating replace IC1.
2. Zero volts DC output, minus side of LND-X-152 or 9 to 12V output of LND-X-MPU.	Q21, R27 open.	Check Q21, R27 for open, replace as necessary.
	Short circuit across output of supply.	Check load and load connections, correct as necessary.

TROUBLE SHOOTING CHART

Symptom	Possible Cause	Remedy
	Shorted CR26 or C24	Check CR26 and C24 for short, replace as necessary.
	IC21 defective.	See "IC1 Defective".
3. Unable to adjust output voltage.	Damaged VDC ADJ. control.	Check R10, R20 for short or open, replace as necessary.
4. High ripple at twice line frequency and unregulated DC output, both sides of LND-X-152 or 5V output of LND-X-MPU.	Q1 shorted	Check Q1 for short, replace as necessary.
	Jumper between terminals +V and +S open. Jumper between -V and -S open (LND-X-MPU).	Refer to figures 3-8 for proper supply terminal connections.
	IC1 defective.	See "Symptom 1".
5. High ripple at twice line frequency and unregulated DC output, minus side of LND-X-152 or 9 to 12V output of LND-X-MPU.	Q21 shorted	Check Q21 for short, replace as necessary.
	Jumper between terminals -V and -S open. Jumper between terminals +V and +S open (LND-X-MPU).	Refer to figures 3-8 for proper supply terminal connections.
	IC21 defective.	See "IC1 Defective".
6. High ripple at line frequency, both sides of LND-X-152 or 5V output of LND-X-MPU.	Defective main rectifier.	Check for open or short CR1A, CR1B.
	C1 open.	Check C1 for open, replace as necessary.
7. High ripple at line frequency, minus side of LND-X-152 or 9 to 12V output of LND-X-MPU.	Defective main rectifier.	Check for open or short CR21A, CR21B (LND-X-152); CR21, CR22 (LND-X-MPU).
	C21 open.	Check C21 for open, replace as necessary.
8. High ripple at frequency other than line or twice line frequency.	Oscillation due to defective component in filter network.	Check for open C3, C4, C23, C24, R16, and R36.
9. Regulated high output voltage, limited voltage adjust range, both sides of LND-X-152 or 5V output of LND-X-MPU.	Defective IC1.	See "Symptom 1".

TROUBLE SHOOTING CHART

Symptom	Possible Cause	Remedy
10. Regulated high output voltage, minus side of LND-X-152 or 9 to 12V output of LND-X-MPU.	Defective IC21.	See "Defective IC1".
11. Very low output voltage on model LND-X-MPU, either side.	HC1 or IC22 fired due to 0V condition.	Momentarily interrupt AC input. If supply operates normally, a transient has occurred in line or load, check wiring (switches, etc.). If supply fails to reach full output voltage, remove AC input, disconnect +V pin or HC1 or, as applicable pin 2 of IC22; remove load; apply AC power and refer to procedure for: Unregulated DC Output "Symptom 4 or 5".

PERFORMANCE CHECKS

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 11 or, as applicable, figure 12. Use suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the differential meter, DC DVM (John Fluke Model 891A or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the load to no-load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 105—127 or 127—105 volts AC and check the power-supply line regulation accuracy on the TVM differential meter.

Use a TVM, John Fluke Model 931B or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output.

Perform checks on both outputs of the power supply.

ADJUSTMENT OF CALIBRATION CONTROL R4 (5V OUTPUT OF LND-X-MPU)

Whenever Q1, R7, R8, R4, R5, or IC1 are replaced, and voltage and current indications do not reflect maximum ratings, adjust R4 as follows. The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30°C, and is stabilized and not operating.

1. Remove AC input power to the supply.
2. Break seal on wiper of R4 from resistor housing and turn to full CW position.
3. Operate power supply for constant voltage with local sensing, connected as shown in figure 5, with no external load.
4. Turn voltage adjust control until minimum rated output voltage is obtained.

5. Apply load so that output current is 130% of 40° C rating for the unit.

6. Using an oscilloscope. Tektronix 503 or equivalent, observe output voltage while adjusting R4 in CCW direction. Adjust R4 until output ripple begins to increase.

7. Turn voltage adjust control until maximum rated output voltage is obtained.

8. Increase load. Maximum attainable load current shall not exceed 150% of 40° C rating for the unit.

9. After adjustment is completed, remove AC power input to the supply and use glyptol sealant to seal wiper of R4 to resistor housing.

10. After sealing, check setting and repeat adjustment procedure if required.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest Lambda office where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information, Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used with the Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.

2. Lambda part number.

3. Description of part together with circuit designation.

4. If part is not an electronic part, or is not listed, provide a description, function, and location of the part.

PARTS LIST

The electrical parts located on Lambda models LND-X-152 and LND-X-MPU are listed here. Parts common to both models are listed first. Unique parts of individual models are listed separately, by model, immediately following the common-parts listing. In addition there is a separate listing of parts for the "J" option.

COMMON PARTS
MODELS LND-X-152 AND LND-X-MPU

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
C2	Cap., elect., 180 mf -10 +100%, 40 vdc	CBR-18-155
C3	Cap., ceramic, 0.001 mf ±20%, 1,000 vdc	CDX-10-010
C5, C6	Cap., mylar, 0.01 mf ±10%, 200 vdc	CGL-10-002
C7 thru C20	Not assigned	
C21	Cap., elect., 4,300 mf -10 +100%, 30 vdc	CBS-43-161
C22	Not assigned	
C23	Same as C3	
C24	Same as C2	
C25, C26	Same as C5	
CR1	Rectifier, dual	FBL-00-139
CR2	Not assigned	
CR3, CR5	Rectifier	FBL-00-080
CR7 thru CR20, CR23, CR27 thru CR34	Not assigned	
IC1	Integrated circuit	FBT-00-073
IC2 thru IC20	Not assigned	
IC21	Same as IC1	
Q2 thru Q20	Not assigned	
R2	Res., comp., 1,000 ohms ±10%, ½ w	DEB-1021
R3, R11, R12	Not assigned	
R13	Res., comp., 27 ohms ±5%, ½ w	DEB-2705
R15	Not assigned	
R16	Res., comp., 10 ohms ±10%, ½ w	DEB-1001
R17 thru R19, R21	Not assigned	
R22	Same as R2	
R30, R32	Not assigned	
R33	Same as R13	
R35	Not assigned	
R36	Same as R16	
S1	Thermostat	FKA-124-013

UNIQUE PARTS
MODEL LND-X-152

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
C1	Cap., elect., 4,300 mf -10 +100%, 30 vdc	CBS-43-161
C4	Cap., elect., 180 mf -10 +100%, 40 vdc	CBR-18-155
C27	Cap., ceramic, 0.1 mf ±20%, 100 vdc	CDM-10-003
CR4	Rectifier, zener diode	FBM-Z105
CR6	Rectifier	FBL-00-094
CR21	Rectifier, dual	FBL-00-139
CR22	Not assigned	
CR24	Same as CR4	
CR25	Not assigned	
CR26	Same as CR6	
CR35	Rectifier	FBL-00-080
Q1, Q21	Transistor, NPN	FBN-L170
R1	Res., ww, 2,000 ohms ±3%, 3 w	DFS-20-082
R4	Not assigned	
R5	Res., film, 2,490 ohms ±1%, ½ w	DCS-25-087
R6	Res., film, 345 ohms ±1%, ¼ w	DCR-35-051
R7	Res., ww, 0.15 ohm ±5%, 3 w	DLM-15-009
R8	Not assigned	
R9	Res., film, 1,000 ohms ±1%, ¼ w	DCS-10-065
R10	Res., var., cermet, 1,200 ohms ±20%, 1 w	DRS-12-015
R14	Res., film, 105 ohms ±1%, ¼ w	DCR-11-039
R20	Not assigned	
R23	Res., film, 8,870 ohms ±0.5%, ¼ w	DCS-89-090
R24	Res., film, 95.3 ohms ±1%, ¼ w	DCP-95-019
R25	Same as R5	
R26	Res., film, 887 ohms ±0.5%, ¼ w	DCR-89-094
R27	Same as R7	
R28	Same as R26	
R29	Res., film, 3,970 ohms ±0.5%, ¼ w	DCS-40-119
R31	Res., ww, 4,100 ohms ±3%, 3 w	DFS-41-090
R34	Res., film, 523 ohms ±1%, ¼ w	DCR-52-100
T1	Transformer	ABA-LNDX-152

MODEL LND-X-MPU

C1	Cap., elect., 17,000 mf -10 +100%, 15 vdc	CBT-17-073
C4	Cap., elect., 700 mf -10 +100%, 15 vdc	CBR-70-151

UNIQUE PARTS (Cont.)

MODEL LND-X-MPU (Cont.)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
CR4	Rectifier, zener diode	FBM-Z155
CR6	Not assigned	
CR21, CR22	Rectifier	FBL-00-094
CR24	Not assigned	
CR25	Rectifier	FBL-00-030
CR26	Not assigned	
HC1	Hybrid circuit	L-12-OV-5
IC22	Integrated circuit	L-6-OV-12
Q1	Transistor, NPN	FBN-L164
Q21	Transistor, NPN	FBN-L172
R1	Res., ww, 500 ohms ±3%, 3 w	DFR-50-018
R4	Res., var., cermet, 600 ohms ±20%, 1 w	DRR-60-009
R5	Res., comp., 1,200 ohms ±10%, ½ w	DEB-1221
R6	Res., film, 499 ohms ±1%, ½ w	DCR-50-029
R7, R8	Res., ww, 0.1 ohm ±5%, 2 w	DLM-10-011
R9	Res., film, 261 ohms ±1%, ¼ w	DCR-26-049
R10	Res., var., cermet, 400 ohms ±10%, 1 w	DRR-40-013

UNIQUE PARTS (Cont.)

MODEL LND-X-MPU (Cont.)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
R14	Not assigned	
R20	Res., var., cermet, 1,400 ohms ±10%, 1 w	DRS-14-025
R23	Not assigned	
R24	Res., film, 105 ohms ±1%, ¼ w	DCR-11-039
R25	Not assigned	
R26	Same as R6	
R27	Res., ww, 0.3 ohm ±5%, 2 w	DLM-30-012
R28	Not assigned	
R29	Res., film, 1,000 ohms ±1%, ¼ w	DCS-10-055
R31, R34	Not assigned	
T1	Transformer	ABA-LNDX-MPU

PARTS FOR "J" OPTION

On all LND-X models with suffix "J", transformer T1 changes. For transformer T1 used on these models, see standard LND-X model parts list for standard transformer part no. and add suffix "J" to the part no.

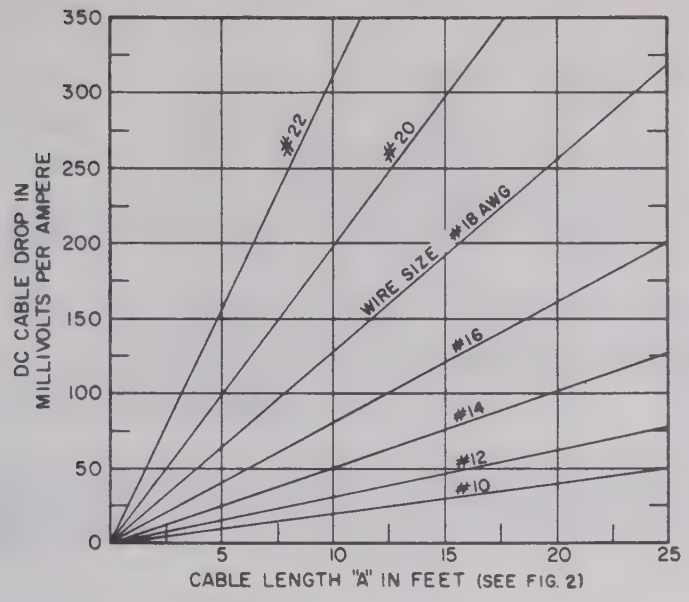


Figure 1. Cable Connection Chart

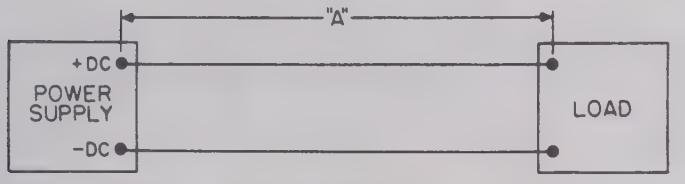


Figure 2. Cable Length "A" in Feet

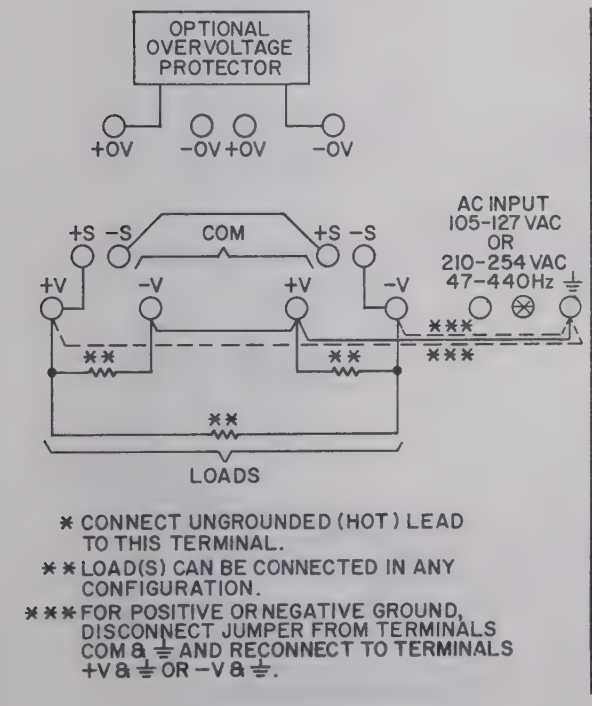


Figure 3. Local Sensing Connection (Model LND-X-152).

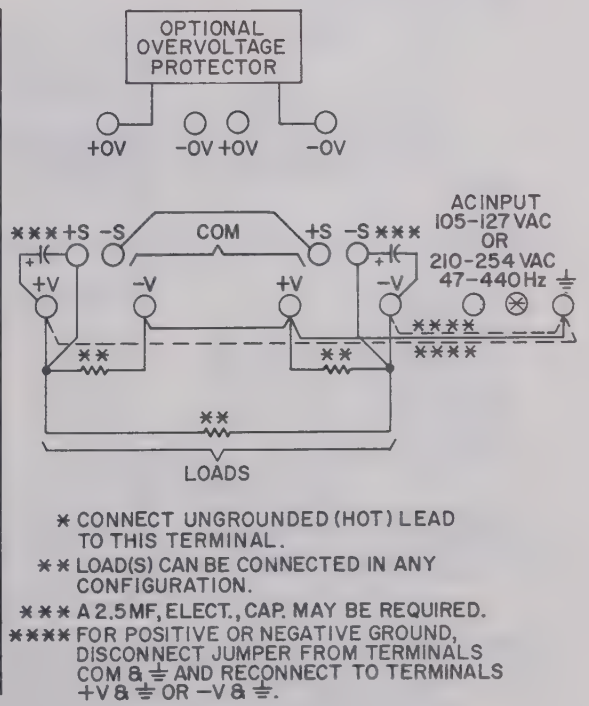


Figure 4. Remote Sensing Connection (Model LND-X-152).

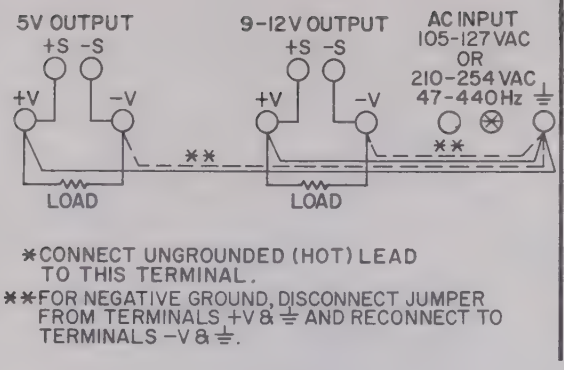


Figure 5. Local Sensing Connection (Model LND-X-MPU).

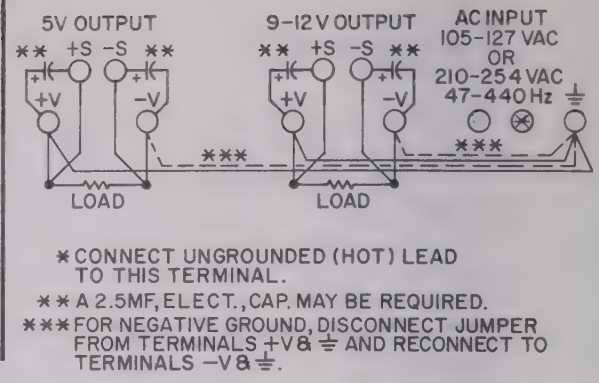


Figure 6. Remote Sensing Connection (Model LND-X-MPU).

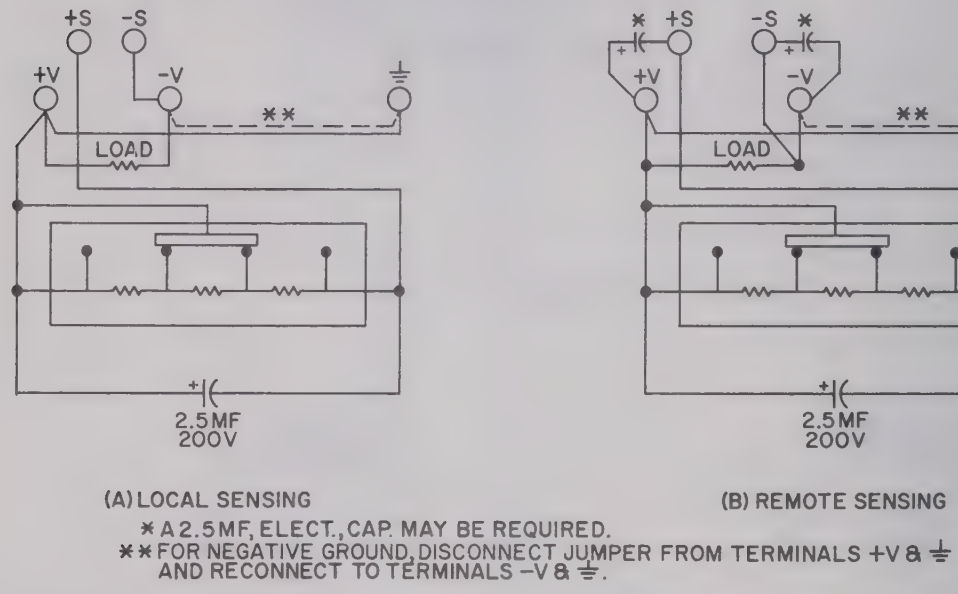


Figure 7. Programmed Voltage, With External Resistor (LND-X-MPU Only).

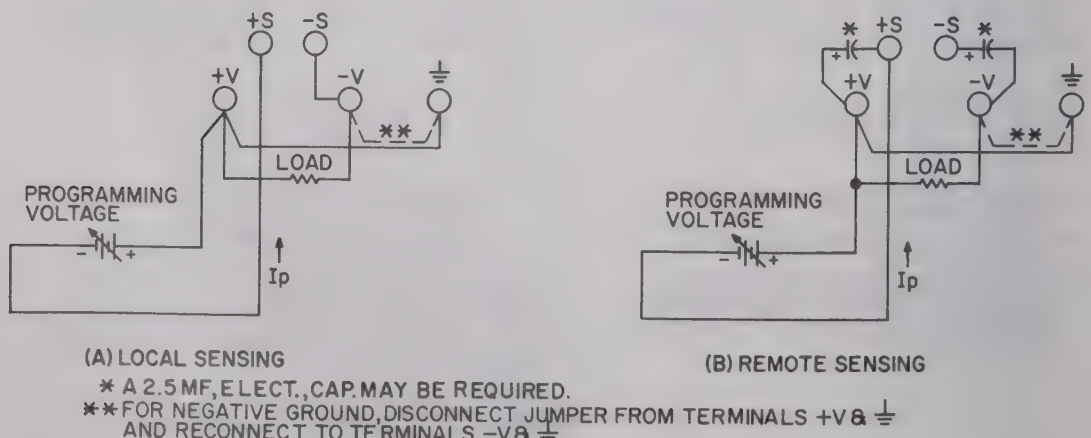
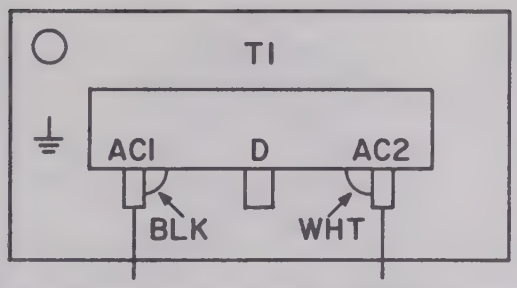
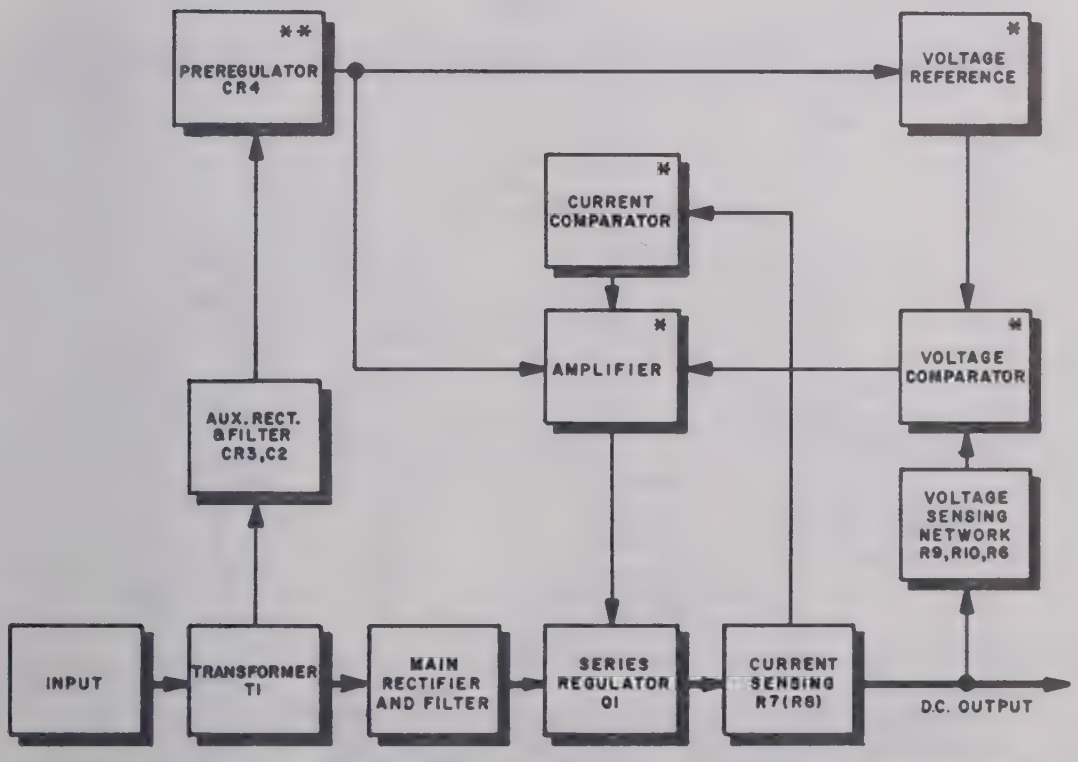


Figure 8. Programmed Voltage, With External Programming Voltage Source (LND-X-MPU Only).



CONNECTION SHOWN IS FOR 105-127 VAC. FOR 210-254 V INPUT, DISCONNECT BLK & WHT TRANSFORMER LEADS FROM TERMINALS AC1 & AC2 AND RECONNECT BOTH LEADS TO TERMINAL D.

Figure 9. Transformer Connections for AC Input Conversion.

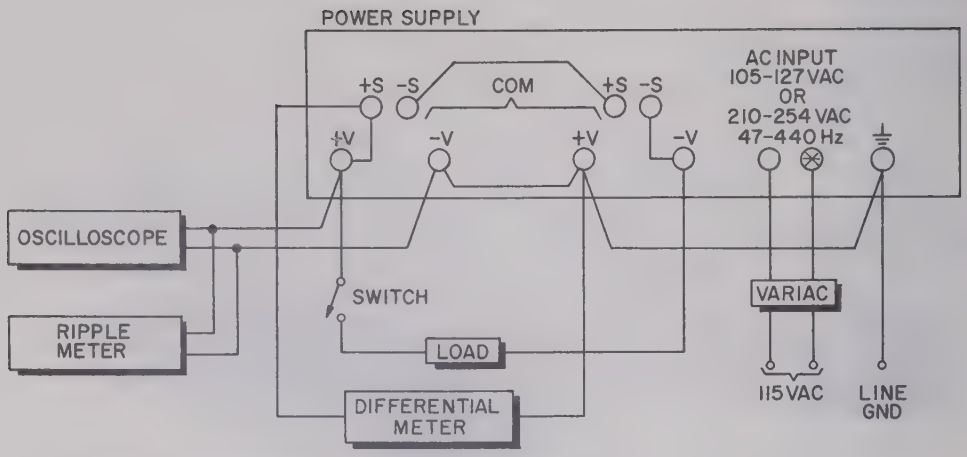


NOTE: THIS DIAGRAM APPLIES TO (+) SIDE OF LND-X-152 AND 5V OUTPUT OF LND-X-MPU, BUT CAN BE USED FOR (−) SIDE OF LND-X-152 AND 9-12V OUTPUT OF LND-X-MPU BY SUBSTITUTING THE CORRESPONDING COMPONENT CIRCUIT DESIGNATIONS.

* THIS CIRCUIT ELEMENT IS LOCATED IN IC1.

** PREREGULATOR LOCATED IN IC1 ON 9-12V OUTPUT OF LND-X-MPU.

Figure 10. Typical Block Diagram.

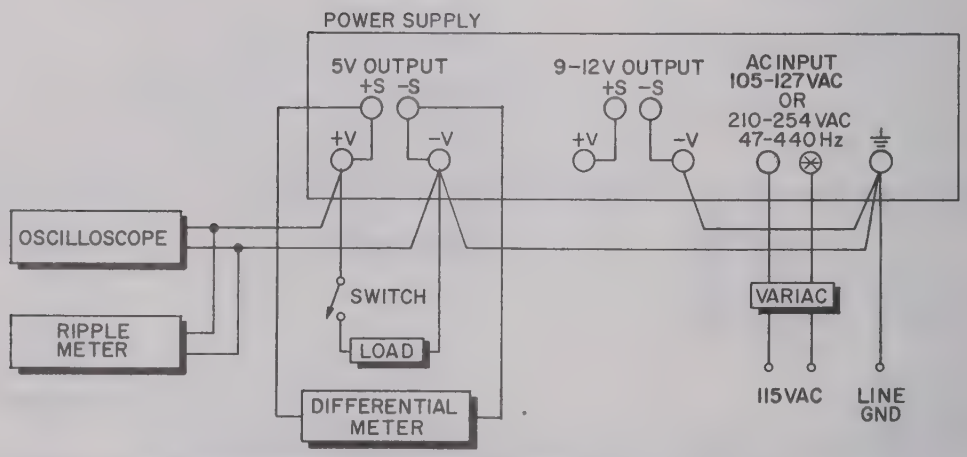


* CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.

NOTES:

1. REGULATION AND RIPPLE CHECK METERS MUST NOT BE GROUNDED THROUGH THREE-WIRE LINE CORD TO GROUND.
2. PERFORM CHECKS WITH LOCAL SENSING CONNECTIONS ONLY.
3. THIS CONFIGURATION APPLIES TO PERFORMANCE CHECKS FOR POSITIVE OUTPUT SIDE. CONNECT OSCILLOSCOPE, RIPPLE METER, AND DIFFERENTIAL METER TO NEGATIVE OUTPUT FOR CHECKS PERFORMED ON THIS SIDE.

Figure 11. Test Connections For Performance Checks (Model LND-X-152).



* CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.

NOTES:

1. REGULATION AND RIPPLE CHECK METERS MUST NOT BE GROUNDED THROUGH THREE-WIRE LINE CORD TO GROUND.
2. PERFORM CHECKS WITH LOCAL SENSING CONNECTIONS ONLY.
3. THIS CONFIGURATION APPLIES TO PERFORMANCE CHECKS FOR 5V OUTPUT. CONNECT LOAD, OSCILLOSCOPE, RIPPLE METER, AND DIFFERENTIAL METER TO 9-12V OUTPUT FOR CHECKS PERFORMED ON THIS OUTPUT.

Figure 12. Test Connections For Performance Checks (Model LND-X-MPU).

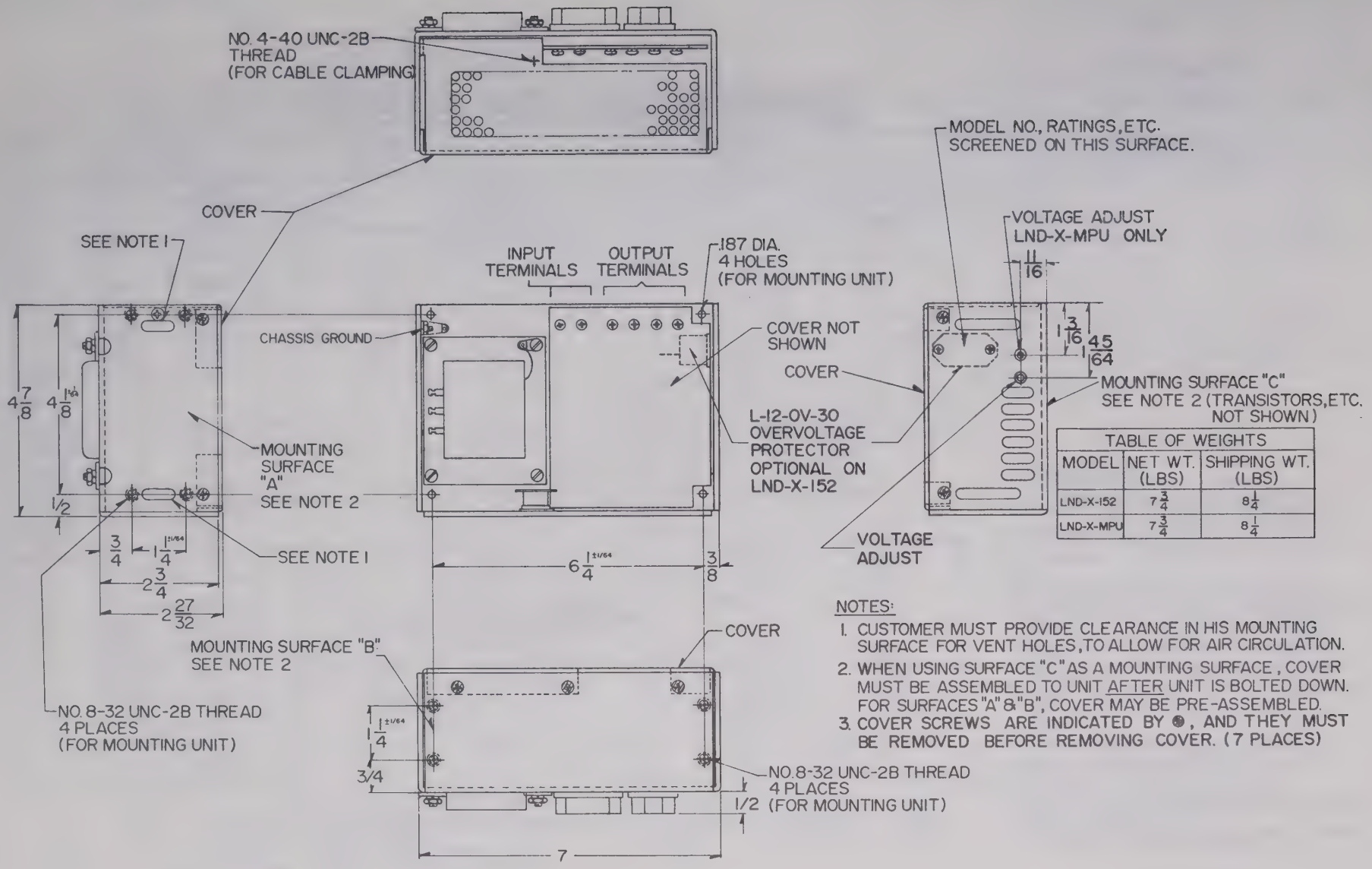
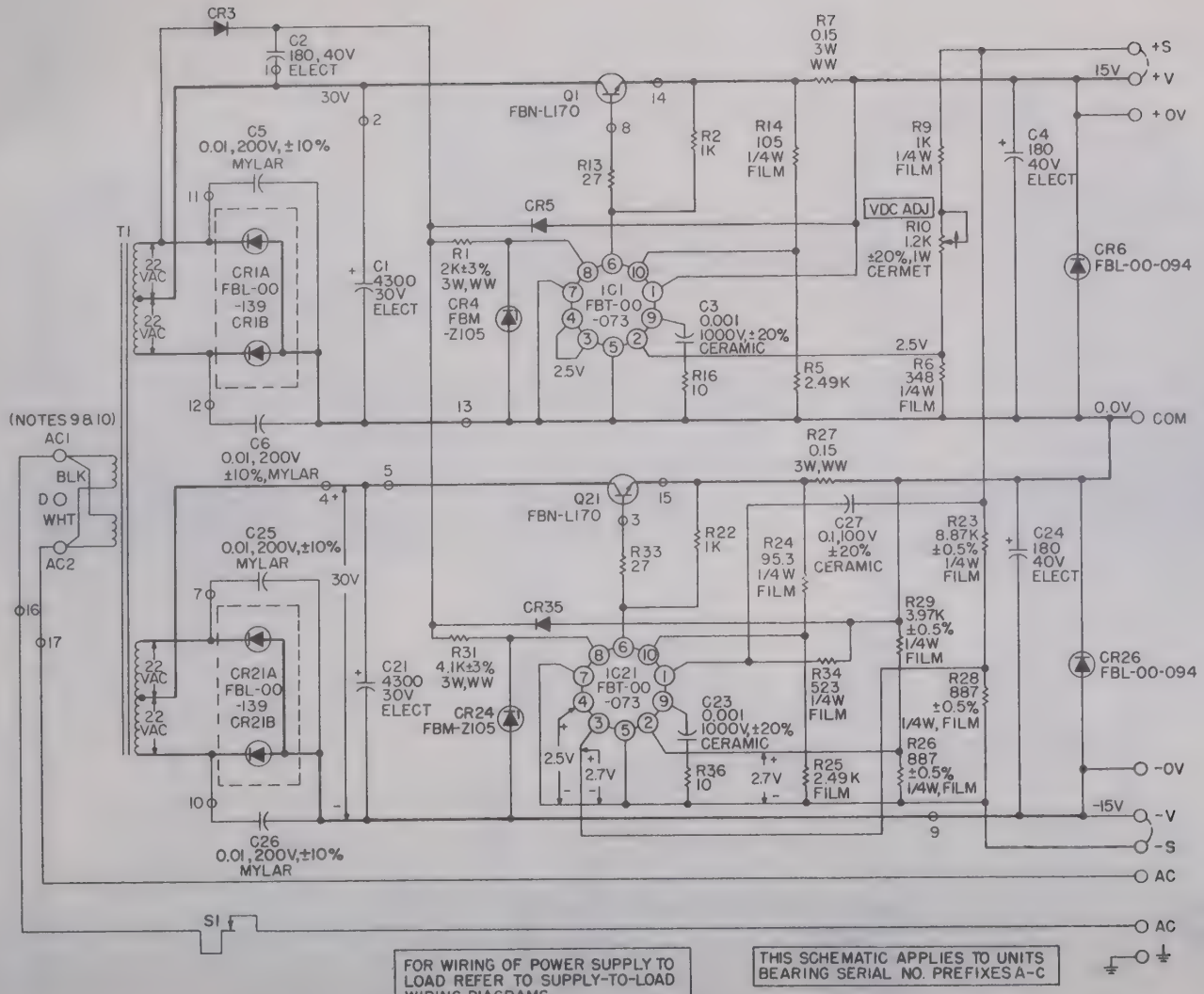

NO. 4-40 UNC-2B THREAD (FOR CABLE CLAMPING)
COVER
SEE NOTE 1
INPUT TERMINALS
OUTPUT TERMINALS
.187 DIA. 4 HOLES (FOR MOUNTING UNIT)
CHASSIS GROUND
COVER NOT SHOWN
COVER
L-12-OV-30 OVERVOLTAGE PROTECTOR OPTIONAL ON LND-X-152
MODEL NO., RATINGS, ETC. SCREENED ON THIS SURFACE.
VOLTAGE ADJUST LND-X-MPU ONLY
MOUNTING SURFACE "C" SEE NOTE 2 (TRANSISTORS, ETC. NOT SHOWN)
MOUNTING SURFACE "A" SEE NOTE 2
SEE NOTE 1
VOLTAGE ADJUST
MOUNTING SURFACE "B" SEE NOTE 2
COVER
NO. 8-32 UNC-2B THREAD 4 PLACES (FOR MOUNTING UNIT)
NO. 8-32 UNC-2B THREAD 4 PLACES (FOR MOUNTING UNIT)
1/2
3/4
7

TABLE OF WEIGHTS		
MODEL	NET WT. (LBS)	SHIPPING WT. (LBS)
LND-X-152	7 3/4	8 1/4
LND-X-MPU	7 3/4	8 1/4

NOTES:

1. CUSTOMER MUST PROVIDE CLEARANCE IN HIS MOUNTING SURFACE FOR VENT HOLES, TO ALLOW FOR AIR CIRCULATION.
2. WHEN USING SURFACE "C" AS A MOUNTING SURFACE, COVER MUST BE ASSEMBLED TO UNIT AFTER UNIT IS BOLTED DOWN. FOR SURFACES "A" & "B", COVER MAY BE PRE-ASSEMBLED.
3. COVER SCREWS ARE INDICATED BY ⊛, AND THEY MUST BE REMOVED BEFORE REMOVING COVER. (7 PLACES)

Figure 13. Outline Drawing.



1. RESISTORS ARE CARB. FILM 1/2W WITH VALUE IN OHMS UNLESS OTHERWISE NOTED.
2. RESISTOR TOLERANCES: CARB. FILM ±5%, FILM ±1%, WIRE-WOUND ±5%, UNLESS OTHERWISE NOTED.
3. CAPACITOR VALUES ARE IN MICROFARADS.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10+100%.
5. DESIGNATIONS ARE LAMBDA PART NUMBERS.
6. SYMBOLS:
   - INDICATES CLOCKWISE ROTATION OF SHAFT.
   - LAMBDA PART NO. FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - INDICATES TERMINAL ON PRINTED CIRCUIT BOARD.
7. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT 115 VAC, 60 Hz; OUTPUT: 15 VDC, NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN COM. AND INDICATED POINTS UNLESS OTHERWISE NOTED.
8. FOR INPUT OTHER THAN 57-63 Hz CONSULT FACTORY.
9. T1 PRIMARY CONNECTION SHOWN IS FOR 105-127 VAC INPUT. FOR 210-254 VAC INPUT: DISCONNECT BLK & WHT TRANSFORMER LEADS FROM TERMINALS AC1 & AC2. RECONNECT BOTH LEADS TO TERMINAL D.
10. "J" OPTION UNITS HAVE SINGLE T1 PRIMARY. AC INPUT IS 90-110 VAC.

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS.

DOTTED CONNECTIONS SHOWN INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

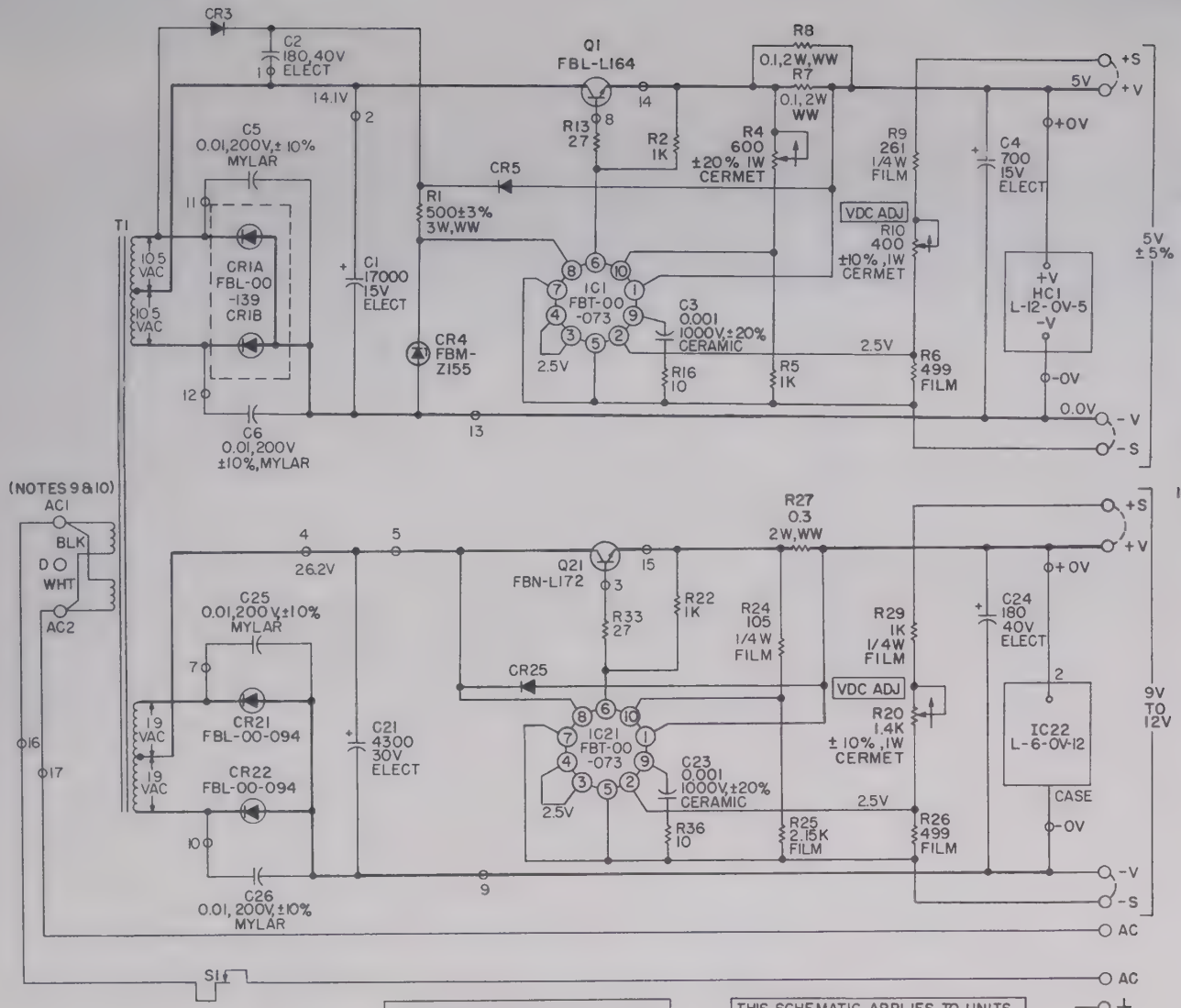
THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIXES A-C

SCHEMATIC DIAGRAM

REGULATED POWER SUPPLY
MODEL LND-X-152

LAMBDA
ELECTRONICS
MELVILLE, NEW YORK

DIVISION OF Vesco INSTRUMENTS INC.



1. RESISTORS ARE CARB. FILM 1/2W WITH VALUE IN OHMS UNLESS OTHERWISE NOTED.
2. RESISTOR TOLERANCES: CARB. FILM ±5%, FILM ±1%, WIRE-WOUND ±5%, UNLESS OTHERWISE NOTED.
3. CAPACITOR VALUES ARE IN MICROFARADS.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10+100%.
5. DESIGNATIONS ARE LAMBDA PART NUMBERS.
6. SYMBOLS:
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   - INDICATES TERMINAL ON PRINTED CIRCUIT BOARD.
7. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT 115 VAC, 60 Hz; OUTPUT: RATED VOLTAGE, NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN -V OF APPLICABLE OUTPUT AND INDICATED POINTS UNLESS OTHERWISE NOTED.
8. FOR INPUT OTHER THAN 57-63 Hz CONSULT FACTORY.
9. T1 PRIMARY CONNECTION SHOWN IS FOR 105-127 VAC INPUT. FOR 210-254 VAC INPUT: DISCONNECT BLK & WHT TRANSFORMER LEADS FROM TERMINALS AC1 & AC2. RECONNECT BOTH LEADS TO TERMINAL D.
10. "J" OPTION UNITS HAVE SINGLE T1 PRIMARY. AC INPUT IS 90-110 VAC.

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SCHEMATIC DIAGRAM

REGULATED POWER SUPPLY
MODEL LND-X-MPU

LAMBDA

ELECTRONICS
MELVILLE, NEW YORK

DIVISION OF Veeco INSTRUMENTS INC.

TABLE OF CONTENTS

Addenda

Added Parts List

Schematic (Size A)

STD Instruction Manual LND-X-Series

MODEL #LND-X-152-2364

ADDENDA

MODEL #LND-X-152-2364

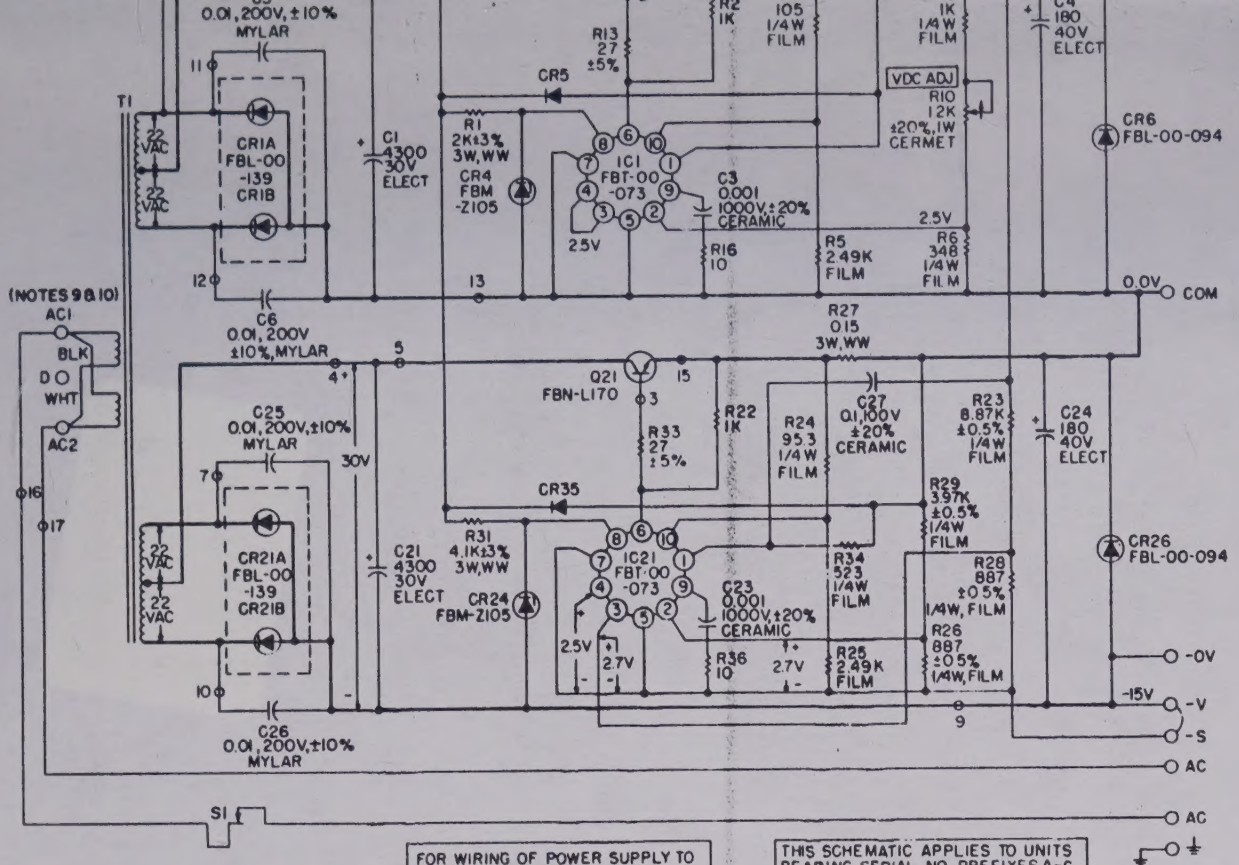
Lambda Model LND-X-152-2364 has all catalog specs. applicable to Model LND-X-152, with the following deviations:

The D.C. output is ± 10V @ 1.3A @ 40°C.

DEVIATION FROM AND/OR ADDED PARTS TO STANDARD ELECTRICAL PARTS LIST

MODEL #LND-X-152-2364

CIRCUIT DESIG.	DESCRIPTION	LAMBDA NO.
R9	Resistor, Film 825 Ω ±1%, ¼W	DCR-82-053
R10	Resistor, Variable Cermet 600 Ω, 20%, 1W	DRR-60-009
R23	Resistor, 5.6K, ohm ± .5% ½W Film	DCS-56-042
R29	Resistor, 2.4K, ± 5% ½W	DCS-24-001



1. CAPACITANCE VALUES ARE IN MICROFARADS.
2. RESISTANCE VALUES ARE IN OHMS, K=1000.
3. CAPACITOR VOLTAGE RATINGS ARE MINIMUM.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10+100%.
5. DESIGNATIONS ARE LAMBDA PART NUMBERS.
6. SYMBOLS:
   - ↑ INDICATES CLOCKWISE ROTATION OF SHAFT.
   - ▶ LAMBDA PART NO. FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - —o— INDICATES TERMINAL ON PRINTED CIRCUIT BOARD.
7. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT 115 VAC, 60 Hz; OUTPUT: 15 VDC, NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN COM. AND INDICATED POINTS UNLESS OTHERWISE NOTED.
8. FOR INPUT OTHER THAN 57-63 Hz CONSULT FACTORY.
9. T1 PRIMARY CONNECTION SHOWN IS FOR 105-127 VAC INPUT. FOR 210-254 VAC INPUT: DISCONNECT BLK & WHT TRANSFORMER LEADS FROM TERMINALS AC1 & AC2. RECONNECT BOTH LEADS TO TERMINAL D.
10. "J" OPTION UNITS HAVE SINGLE T1 PRIMARY. AC INPUT IS 90-110 VAC.

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THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIXES A-C

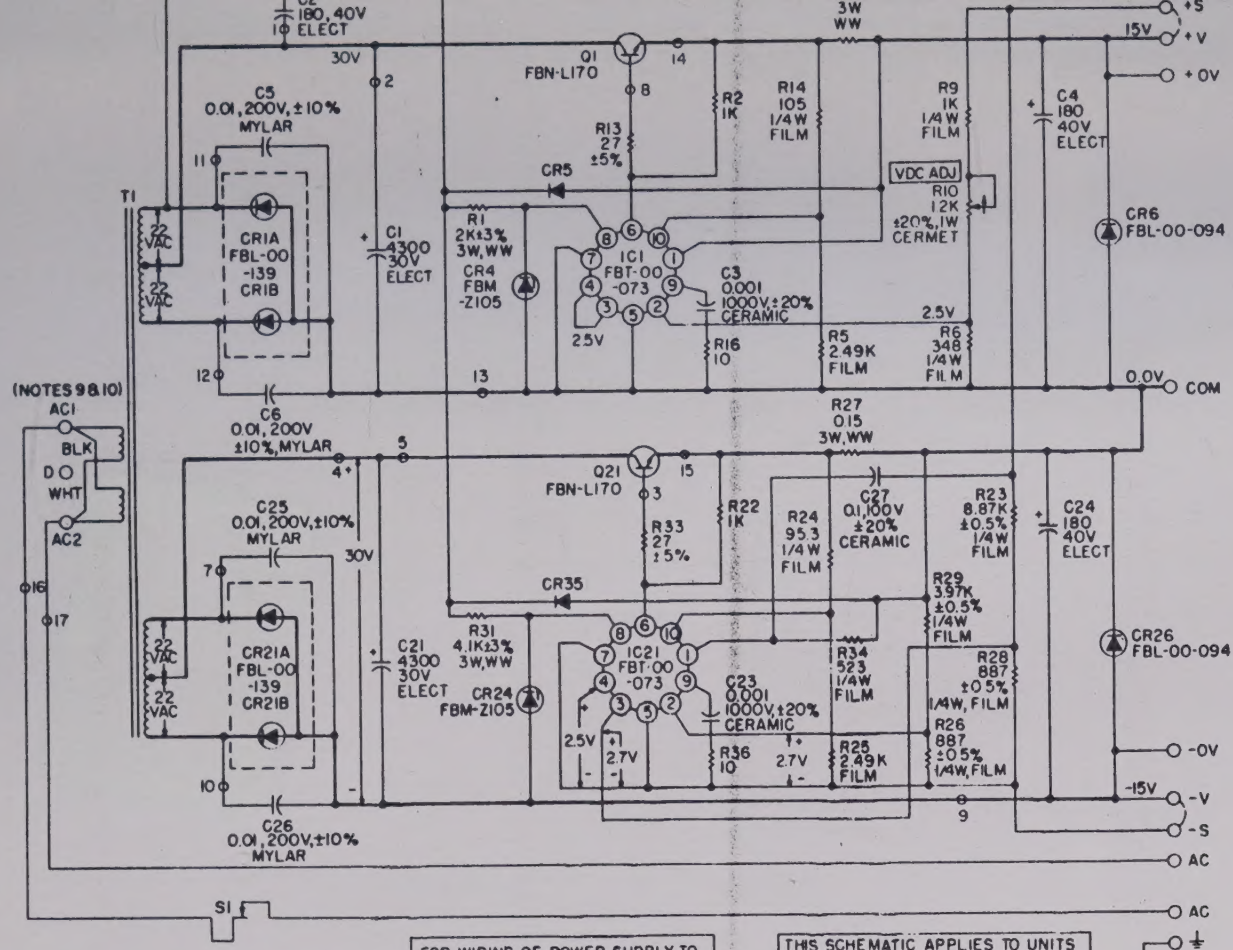
SCHEMATIC DIAGRAM

REGULATED POWER SUPPLY
MODEL LND-X-152-2364

LAMBDA
ELECTRONICS
MELVILLE, NEW YORK

DIVISION OF Veeco INSTRUMENTS INC

SYM	DESCRIPTION	DATE	APPL.
A	ORIGINAL	9-10-85	



1. RESISTORS ARE COMP. 1/2W WITH VALUE IN OHMS UNLESS OTHERWISE NOTED.
2. RESISTOR TOLERANCES: COMP. ±10%, FILM ±1% WIRE-WOUND ±5%, UNLESS OTHERWISE NOTED.
3. CAPACITOR VALUES ARE IN MICROFARADS.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10+100%.
5. DESIGNATIONS ARE LAMBDA PART NUMBERS.
6. SYMBOLS:
   - ↑ INDICATES CLOCKWISE ROTATION OF SHAFT.
   - ▶ LAMBDA PART NO. FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - —o— INDICATES TERMINAL ON PRINTED CIRCUIT BOARD.
7. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT 115 VAC, 60 Hz; OUTPUT: 15 VDC, NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN COM. AND INDICATED POINTS UNLESS OTHERWISE NOTED.
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9. T1 PRIMARY CONNECTION SHOWN IS FOR 105-127 VAC INPUT. FOR 210-254 VAC INPUT: DISCONNECT BLK & WHT TRANSFORMER LEADS FROM TERMINALS AC1 & AC2. RECONNECT BOTH LEADS TO TERMINAL D.
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SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY
MODEL LND-X-152-2364

LAMBDA
ELECTRONICS
MELVILLE, NEW YORK
DIVISION OF Veeco INSTRUMENTS INC

SYM	DESCRIPTION	DATE	APPL.
A	ORIGINAL	9-10-85	

MP MASTER
MA28811